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Interpretation bias in anxiety a synthesis of studies with children and adolescents

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Abstract

We present a synthesis of the studies that have investigated the interpretation bias of ambiguous information in children and adolescents with anxiety. In particular, we examine how the threat is perceived, if it is general or specific and in accordance with the anxiety, the probability and cost of social events, judgment on the probability of future negative events and their occurrence to oneself *vs.* others and parents' influence on the interpretation of ambiguity by their children. Finally, we review the classical theoretical models (i.e, the Schema Theory and Associative Network Theory) and more recent one (i.e., the theory of Williams et al., 1988, 1997) which try to explain this bias.

Keywords: Interpretation bias, anxiety, children.

1. Introduction

The interpretation bias consists of systematically assigning a threatening meaning to an objectively ambiguous stimulus with several possible interpretations. This bias has been widely studied in adults with anxiety (see Castillo 2010a for a review) and depression, but to a lesser extent in children; despite research into children having improved a great deal over the last two decades, as shown by the reviews of Daleiden and Vasey (1997), Gotlib and MacLeod (1997) and Vasey and MacLeod (2001).

To examine this bias in children, homophone and homograph paradigms, ambiguous vignettes and variations have been used -"Reduced Evidence for Danger" (RED) and "Space Odyssey"-, projected techniques and pictorial material. In the homophone paradigm (Hadwin, Frost, French y Richards, 1997), words with the same pronunciation but different graphic representation and meaning are presented; for example, die/dye, groan/grown, pain/pane. The procedure consists of presenting the homophone aurally and asking the subjects to write down the word they have heard. In this way, we obtain the interpretation they have made of the homophone.

Homographs (Taghavi, Moradi, Neshat-Doost, Yule, and Dalgleish, 2000) are words with the same graphic representation but different meaning; for example, *sentence* can mean a phrase or punishment; *revolution*, a turn or war; *stole*, a scarf or robber. The task consists of reading homographic words and then making a phrase with them.

In the studies with vignettes (Barrett, Rapee, Dadds, and Ryan, 1996; Chorpita, Albano, and Barlow, 1996; Waters, Craske, Bergman, and Treanor, 2008), brief descriptions of ambiguous everyday situations in the lives of

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children are presented and the subjects are asked to indicate the most probable result of these from two options – threatening *vs.* neutral. A variation of this paradigm is the one known as the "Reduced Evidence for Danger" (RED). In this one, the children are told that the situations will have an "unhappy" or "happy" ending, and they are asked to decide if the story is frightening or not. Another ingenious variation is the "Space Odyssey" (Muris, Huijdin, Mayer, and Hameetman, 2008). It consists of a computer program in which the child makes an imaginary trip in space to an unknown planet to find out about the lives of its inhabitants. Brief scenarios are described and the children have to choose between a negative or positive result.

In studies with projected techniques, Muris and van Doorn (2003) use images from the Thematic Apperception Test and the Columbus Test in a segmented form to investigate if this abnormal way of perceiving a threat occurs in the absence of verbal information.

Finally, In-Albon, Klein, Rinck, Becker and Schneider (2008) have come up with a pictorial paradigm of forced choice in which images represent social situations and ones of separation.

Studies involving all these paradigms are prone to an interpretative bias of threat, in which the ambiguous information is interpreted as threatening. There is empirical evidence that differences in information processing exist among children and adolescents with high and low levels of anxiety. Furthermore, this bias is analogous to that observed in adults (see Castillo 2010a), as well as to the attentional bias in children (Dubner and Motta, 1999) and in adults (see Castillo, 2003, 2004 for review).

2. Perception of the threat. General or specific?

It is of interest to find out how children perceive threat and the way in which they perceive it when they suffer from some kind of anxiety disorder. If they always perceive the threat as something negative, regardless of their disorder, it would be considered as having a *general* character. If, on the other hand, it is related to their disorder, it has a *specific* character.

Muris and cols. have carried out various studies to examine this characteristic of threat. In their first study, Muris, Merckelbach and Damsma (2000) presented socially ambiguous scenarios with instructions to children to indicate if they made them frightened or not. They also had to say how each story might end and how they might feel if they had to face the situation in reality. Children with social anxiety: a) presented lower thresholds for threat perception than the control group, b) perceived threats more often, and c) interpreted the stories as being threatening more often and showed higher levels of negative feelings and cognitions related to the stories than the control group.

In their second study, Muris, Kindt, Bögels, Merckelbach, Gadet and Moulaert (2000) replicated the results of previous study. With respect to general *vs.* specific bias, the results suggested that the abnormalities in threat perception were more influenced by the general level of anxiety than by a specific kind of alteration.

In the third study, Muris, Luerman, Merckelbach and Mayer (2000) found the same results as in the previous studies, except for the abnormal way in perceiving the threat that had a specific character and was not solely influenced by levels of general anxiety. A novel result is that the non-threatening stories were also perceived as threats, which suggests that when children with anxiety face this type of non-threatening situation a bias is produced tending to expect threatening consequences. Therefore, these results not only indicate that anxiety is accompanied by an abnormal perception of threat, but also that these distortions appear when facing benign situations.

In summary, anxiety is associated with a high level of threat perception and low threshold for its detection. As for the general or specific character, the data presented are mixed, favoring the general character in some studies (e.g., Muris, Kindt, et al, 2000) and the specific in others (e.g., Bögels and Zigterman, 2000; Dalgleish et al., 2003; In-Albon, Klein, Rinck, Becker and Schneider, 2008; Muris, Luerman, Merckerbach and Mayer, 2000). This specific nature in children coincides with that found in adults; however, before determining the specific character in children for sure, more evidence is required from different samples and emotional disorders, as at the moment the number of studies that have tackled this question are few.

2.1. Temporal stability in threat perception

Few studies have examined temporal stability in threat perception of children. Muris, Jacques, and Mayer (2004) presented a group of children with stories containing several ambiguous phrases about which they had to determine different levels of threat. Four weeks later, they re-interviewed the participants. They hypothesized that on both occasions, anxiety would be associated with an abnormal perception of threat, and that such perception would remain stable for the 4 weeks. They found positive correlations between the scores for anxiety and threat frequency, evaluation and interpretation of threat, and a negative correlation between anxiety and threat threshold. This indicates that high anxiety is accompanied by a high threat perception, high evaluation, frequent threatening interpretation and an early detection of threat in both sessions. Data regarding temporal stability were only moderately correlated between test-retest ranging from 0.44 and 0.63 for the above mentioned values and a correlation of 0.61 for the joint score of all of them. Therefore, anxiety was quite stable on both occasions, while the threat bias only reached moderate stability.

In a further study, Muris, Meesters, Smulders and Mayer (2005) used a longer time interval between sessions –8 weeks–. They obtained a positive correlation between anxiety scores and global threat perception scores $r = 0.43$ and $r = 0.41$ for the first and second sessions, respectively. The high levels of anxiety were associated with high levels of threat perception. The stability in threat perception was quite stable, correlations of test-retest being between 0.71 and 0.87 for the threat values mentioned.

Clearly, stability *vs.* transitory in threat perception awaits greater empirical evidence, due to the small number of studies in this area. Furthermore, this feature is not only important in itself, but also because it is believed to underlie the etiology and maintenance of anxiety disorders.

3. Probability and cost of social events

Rheingold, Herbert and Franklin (2003) researched the probability and cost of negative social and non-social events on adolescents with and without social anxiety. They also studied the effect that the gender of the participants could have on the evaluation of social situations. They hypothesized: a) that adolescents with social anxiety would evaluate social events as more likely and with a higher cost than the control group, and b) there would be no difference between adolescents with anxiety and the control group in the probability and cost of non-social situations. Their results supported the first hypothesis and only partially the second. They observed differences in the evaluation between the group with social anxiety and the control; however, the scores of the group with anxiety in the cost sub-scale for non-social events were higher than the control group's scores. Gender did not turn out to be a significant factor in explaining cognitive biases, which is not in accordance with the literature on this subject (e.g., Craske, 1997; Muris, Huijding, Mayer, and Hameetman, 2008), as evidence supports the fact that adolescent girls are more prone to anxiety than boys.

4. Judging the probability of future negative events and their occurrence to oneself *versus* others

Data on the probability of an event occurrence have traditionally been interpreted in terms of "heuristic probability" (Tversky and Kahneman, 1974), which suggests that the probability of an event is not generated by a process of logical calculation, but in fact depends on the availability that event situations or scenarios, similar to those stored in memories, can be brought to mind at the moment a certain response is given.

Studies on this subject in children and adolescents are scarce, and the data do not concur with those obtained from adults (Butler and Mathews, 1983). Dalgleish, Taghavi, Neshat-Doost, Moradi, Yule, and Canterbury (1997) carried out a study with youngsters with anxiety and depression. In contrast with the results from Butler and Mathews (1983), youngsters with anxiety do not judge that negative events will occur with greater probability than the control group. Furthermore, they judged that these events would more likely occur to *others* than to themselves. This other-focus bias was stronger in the anxiety group than the control group. However, the responses from the group with depression showed that the event could equally as likely happen to them as to others.

The results from Dalgleish et al. (1997) and others (e.g., Canterbury, Golden, Taghavi, Neshat-Doost, Moradi and Yule, 2004; Dalgleish, Moradi, Taghavi, Neshat-Doost, Yule and Canterbury, 2000) show that in anxiety there is a great tendency to judge the probability of negative events happening. Moreover, these are judged as self-focusing in adults and other-focusing in children and adolescents.

5. Parents' influence on the interpretation of ambiguity by their children

It is obvious that parents have an important influence on their children due to genetic, environmental factors or a combination of both (see Rapee, Schniering and Hudson, 2009 for a review). Another question is to determine the specific influence that parents have on the interpretation of ambiguity by their children. The first authors to deal with this issue were Barrett, Rapee, Dadds and Ryan (1996) with three groups: a group with different anxiety disorders; a group with oppositional defiant disorder and a control group. They were presented with 12 vignettes of ambiguous situations and were asked to interpret them and come up with a planned response. A threat interpretation bias was obtained from the participants with high anxiety compared to the control group. Moreover, the response pattern was different for each group: children with the oppositional defiant disorder gave a high number of aggressive responses and the anxious group a high number of avoidant responses. Data from the parents reflect those of the children: parents of the anxious children had a similar number of interpretations of threat as their children and they predicted that they would have a high number of avoidant responses. Parents of children with oppositional behavior had a relatively high level of threat interpretations and predicted aggressive responses in their children. Parents of the children in the control group had a low level of threat interpretation and predicted few responses of avoidance or aggression in their children. According to the authors, these results indicate that children could have learnt to interpret and respond to certain situations within their family contexts.

The results of the effect of family discussion between parents and children on two ambiguous situations provided more data on the possible role of the family in the maintenance of children anxious and aggressive behavior. To study this, changes in the response of children after such discussion were investigated. In children with anxiety, avoidant responses increased considerably after the discussion; children with oppositional behavior also increased their aggressive behavior and the control group reduced the number of avoidant and aggressive responses. These data suggest that the family plays an important role in the child's choice of problem-solving strategy for ambiguity and avoidant behavior in families with anxious children and aggressive responses in families with oppositional behavior are also reinforced. It seems that the family produces an increase in avoidant and aggressive responses in children, a phenomenon that the authors call "FEAR" (Family enhancement of avoidant and aggressive responses). This phenomenon has vital importance; because, if confirmed, it would shed light on the possible origin of anxiety in children; furthermore, it would lead to the development of appropriate preventative programs applicable to parents and children to minimize the adverse effects of anxiety. Several studies have tested this phenomenon (e.g., Chorpita, Albano, and Barlow, 1996; Logsdon-Conradsen, 1998; Cobham, Dadds, and Spence, 1999) with mixed results. Studies by Barrett et al. (1996) and Chorpita et al. (1996) support the existence of the "FEAR" effect in families with anxiety, while studies by Logsdon-Conradsen (1998) and Cobham et al. (1999) reject it.

So far, results from studies on "FEAR" have been contradictory. In the studies with favorable results, the reason given is that the parents of anxious children, due to their own anxiety, view their children's world according to their own negative schemata and interpret ambiguous situations in a negative manner which their children are exposed to and as a result stimulate their children's negative interpretations of these situations (Bögels, van Dongen, and Muris, 2003). Studies to the contrary are based on the idea that the mechanisms involved in the etiology of anxiety in children cannot be captured in such short discussion sessions -5 minutes- (Bögels et al., 2003) or that the families try to give a good impression as if they were families with "normal" children (Shortt, Barrett, Dadds, and Fox, 2001). This discrepancy in the results highlights the need for new data which would allow more definitive conclusions to be drawn on this phenomenon.

6. Theoretical models

The models put forward to explain interpretation bias in children are the same as those for adults. There is the Schema Theory (Beck, 1976; Beck, Emery, and Greenberg, 1985), the Associative Network Theory (Bower, 1981) and the Williams, Watts, MacLeod, and Mathews (1988, 1997) theory.

6.1. Schema Theory (Beck, 1976; Beck, Emery, and Greenberg, 1985)

This theory is based on the idea of a "schema", meaning a functional structure of representations, which are relatively long-lasting, of knowledge and acquired experience. Schemata influence attention, perception, interpretation and memory of new information which are consistent with the content of the schema. The basic hypothesis is that individual differences in the process of information selection are a reflection of different schemata

that are activated in the cognitive system. The theory suggests that each emotion is characterized by a specific cognitive profile, which corresponds to the idiosyncratic content of schemata stored in the memory -*Hypothesis of specific content* -. People with anxiety have "danger schemata" which induce them to process information about their surroundings as a source of threat (physical or psychological). Numerous studies have provided evidence in favor of attention, interpretation and only weakly of memory biases (see Castillo, 2003, 2004, 2010 a, b for review). Therefore, there is coherence between the type of schema hypothesized in people with anxiety and the information they are processing as a priority.

6.2. Associative Network Theory (Bower, 1981)

According to this theory human memory consists of a network of associative concepts and semantic schemata in which the basic processing unit is the proposition, and the process the activation. In our memory, situations and the world in general are represented in an abstract way through a collection of simple units or propositions that describe them. Concepts are represented as *nodes* in the network at different hierarchical levels, when a certain node is activated, the process of activation generalizes from one concept to another or from one proposition to another, following the associative links between them.

Emotions are represented in our memory as emotional units or nodes within the semantic network, in a similar way to conceptual nodes: a specific unit for each emotion. With respect to cognitive biases, this theory suggests that biases are produced in processing information in all cognitive processes and independently of the emotion being dealt with. Evidence does not confirm this generalized occurrence in relation to the processes or for emotions.

6.3. Williams, Watts, Macleod, and Mathews' Theory (1988, 1997)

With regard to cognitive biases, this theory predicts: a) Selective attention bias of information of threat in anxiety and an absence of such bias in depression (the two most studied emotions). It does not predict generalized memory biases in either of the two emotions. Instead, anxiety will produce implicit memory biases, but not explicit memory ones. The opposite occurs with depression: a greater association with explicit memory bias than with an implicit memory one; and b) an interaction effect between anxiety trait and state, and the different effects of each factor.

The reviews of Eysenck (1992) and Williams et al. (1997) have confirmed the existence of different biases for anxiety and depression: anxiety is associated with an attentional bias and the lack of memory bias, and depression is associated with a memory bias and a lack of attentional bias. With respect to interpretation bias, studies in adults (Castillo, 2010a for review) and with children (see present work) confirm its occurrence. In the case of adults, it has been confirmed that this bias is not produced immediately, but delayed, and in which strategic and elaborative processes are implied. Furthermore, an increase in the level of anxiety facilitates its occurrence. The study by Calvo and Castillo (1997) about predictive inferences and experimental conditions of stress evaluation generated more predictive inferences of threat than positive or neutral ones. In contrast, people with low anxiety showed an inhibition of these inferences.

As for memory bias in anxiety, current evidence is contradictory (see Blaney, 1986; Williams et al., 1997; Coles and Heimberg, 2003; Mitte, 2008 for reviews).

As for the interaction between anxious trait and state, studies on attentional bias (e.g., Broadbent and Broadbent, 1988; Mogg, Bradley and Hallowell, 1994) are in favor of this interaction. Under stressful conditions that provoke anxiety, people with high levels of anxiety show an increase in attention towards threatening stimuli (vigilance bias), compared with non-stressful situations. On the other hand, people with lower anxiety showed signs of avoiding such threatening information (avoidant bias). The same results have been obtained for interpretation bias (Calvo and Castillo, 1997).

7. Conclusions

Interpretation bias in children and adolescents has been confirmed with different experimental paradigms. Studies support its existence as a genuine bias, according to which children and adolescents tend to interpret ambiguous stimuli as threatening. Other characteristics of anxiety in this stage of life is that the threat is more highly perceived and with a lower detection threshold. Data on the generality or specificity of threats are still not definitive, as studies that have examined this aspect have shown mixed results, confirming generality in some and specificity in others.

As for the probability and social cost of events, evidence has been found that adolescents overestimate the severity and probability of negative social events happening and they assess social and non-social events in a negative way and with greater impact. One interesting aspect concerns the judgment children make of the probability of future negative events and their occurrence to themselves or others. Data show that whereas the bias in adulthood is self-focusing, in children and adolescents it is other-focusing. With respect to the influence of parents on the interpretation of ambiguity of their children, results indicate that parents have an important influence -"FEAR" phenomenon- nevertheless more studies are required to confirm this phenomenon. Lastly, both classical theories of emotion (Schema and Associative Network Theories) and the Williams et al. Cognitive Theory predict biases in the different cognitive processes associated with anxiety. The evidence is in favor of attention and interpretation biases and more contradictory regarding memory bias.

It is worth noting that the interpretation bias in children and adolescents has only recently been studied in profusion, the majority of the characteristics dealt with here are awaiting greater experimental support. It is recommended that future studies provide new data that will allow more definitive conclusions.

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